NOVEMBER 2018 Update

Macro Base Station Transceiver Update

Major changes to the forecast over the last three months include:

1. Mobile Experts has dramatically increased our forecast for 5G mm-wave base station shipments, to account for increased plans in the USA by AT&T and Verizon to pursue *mobile* 5G in the 24-39 GHz bands, not just *fixed wireless*. We now have confirmation of increased backlog from chipset suppliers that validates a much higher forecast for 2019.

2. The China 5G ramp at 2.6 through 3.5 GHz was adjusted to account for new expectations from MIIT in China: Each of the three operators in China are expected to deploy 500,000 base stations within two years of receiving the 5G spectrum license. We expect the operators to make every attempt to meet this requirement, whether the base stations work or not. This means that all available component capacity will be stretched to the limits from April 2019 through April 2021.

3. We've increased the long term forecast for 5G sub-6 GHz to match expectations for US release of 3.7 GHz spectrum and higher levels of European deployment in the longer term.

4. We've adjusted the proportions of single-mode and multi-mode base stations in 2019 as the market has shifted away from low cost single-mode GSM a bit more.

5. We've increased the number of base stations expected to be deployed in "ultra-dense" urban networks (above 0.1 Gbps/km2/MHz or GkM). Signals from multiple mobile operators indicate higher spending in urban centers and higher urban data growth due to "cord cutting" in urban centers.

6. We have adjusted the breakdown of single mode vs multimode radios, to forecast slightly quicker adoption of multimode capability in the last few percent of the market.

7. Now that the 5G forecast ramp is more clear, we have added an assumed number of transceiver shipments for repair/upgrade to the 5G network after initial deployment. At this point upgrades are expected for Verizon to transition from 5G NR to 5G TF, and we've included an assumed failure rate for lightning strikes and other hardware failures.

8. Roughly half of 5G Sub-6 GHz transceiver shipments will use a 64T64R configuration, based on expectations from Chinese operators. The other half will use 16T and 8T configurations. This proportion is still in flux but the current expectations are for a high proportion of massive MIMO.

9. The breakdown of transceivers by power level was adjusted to reflect a lower number of mm-wave transceivers in the 16T or 32T configuration with higher transceiver power. We are noting production commitments with higher level massive MIMO, which translates to lower power in each transceiver.

10. Transceiver breakdowns by power level were also adjusted to match our forecast with inputs from the component community… we had mistakenly allocated a high percentage of LTE-FDD transceivers to the 20-40W power category instead of the "over 40W" category.

11. The regional transceiver forecast was adjusted to match the renewed production of ZTE in China, Asia Pacific, and Africa, as well as the increase in North America for 5G NR in 2019 to 2020.

12. Market shares have been updated to match with the latest OEM earnings announcements, as well as ZTE's renewed production for a full quarter. Huawei announced 1H2018 YoY growth of 15% in carrier business. Ericsson announced a constant-currency growth rate of 5% YoY, and Nokia's mobile broadband networks business dropped 1% YoY (+1% with constant currency). Note that the ban on shipments to ZTE is over, so we have put ZTE back at their historic levels based on component shipments, assuming that ZTE is shipping product again to their customers.